Teaching Machines and Programed Instruction

Teachers' and Principals' Attitudes Toward Programed Instruction in the Elementary School[1]

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Regardless of the empirical evidence to demonstrate the effectiveness of programed instruction, the question of whether teachers use this method as an integral part of their educational program depends upon many factors. Their attitude toward its value for improving present instructional procedures is one of the most important factors. Although few research reports have concerned themselves with elementary school staff attitudes toward programed instruction, there is some evidence that the *attitude variable* will be a strong factor in the successful implementation of programed instruction in school settings. In a preliminary report of a field study using programed mathematics textbooks, it was found that the programed material without the teacher was superior to programed material used by a teacher with a negative attitude (1). The report made the assumption that "a teacher with an unfavorable attitude not only does not add anything, but actually is a marked negative factor."

[1] This report is based upon a portion of the author's unpublished Ed.D. project at Teachers College, Columbia University (1963).

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This paper will deal with elementary school teachers' and principals' attitudes toward programed instruction after their first experience with a commercial teaching machine and a series of experimental spelling programs.[2]

METHOD

The study was sponsored by the Los Angeles City Board of Education and was conducted over a four-week period during the 1962 school year. The experiment involved 401 students from 12 fifth and sixth grade classes in four randomly selected Los Angeles elementary schools. Of the 12 participating teachers, 8 were female and 4 were male. The average level of training was a B.S. degree (eight) and 10.4 years of teaching experience. Four building principals and two vice principals participated in the experiment. All the administrators were male and had attained the M.A. level of training, with an average of 3.5 years of elementary school administrative experience.

Materials

A commercial teaching machine was used to present the spelling programs. The machines were mechanical and were approximately the size of a portable typewriter. Questions were presented in one window, and the student wrote his response on a separate answer sheet. The student then scored his answer and moved the program on to the next question.

Five fixed-sequence spelling programs were used to present 86 criterion spelling words during the four-week training period. The programs were part of a series originally prepared and used experimentally by Porter during the 1957-58 school year at Harvard (3).

Attitude questionnaires were constructed and used to assess staff attitudes, opinions, and reactions toward a variety of topics related to teaching machines and programed instruction in spelling and to the potential value of the programed method for instructional purposes in general.

Procedures

Twenty-one teaching machines were located in a special classroom in each of the four schools. The students and their teachers were given training in the use of the machines and programs and in the proper recording of daily progress on student record forms.

[2] The original study, upon which this report is based, was also concerned with determining fifth and sixth grade student achievement in spelling by the use of programed spelling materials. A detailed report of achievement data is not the province of this paper. However, because of the obvious influence of student performance upon staff attitudes, the most important achievement results will be summarized.

Each class was divided into two groups and came to the teaching machine room daily at a scheduled time for one hour. One group used the machines, while the other group participated in some other activity under teacher direction. At the end of 20 minutes, the groups exchanged places, and the procedure was repeated for another 20 minutes. During the experiment, no other spelling instruction was given, and no homework was permitted. While using the machines, students were not given any instructional assistance and they worked independently, except when mechanical difficulties were experienced in the operation of the teaching machines.

The teachers' and principals' attitude questionnaires were filled out upon the completion of the spelling posttest. After tabulation and analysis of the questionnaires, structured interviews were conducted with each of the teachers and administrators.

RESULTS

Student Achievement

The experimental group of 401 students achieved a mean gain of 16.5 words (19.5 percent increase) and completed the five spelling programs in 186.7 minutes (mean training time), which was approximately nine days and seven minutes of programed instructional time. By estimating the number of words taught in a typical week of conventional spelling workbook instruction, the 86 spelling words represented approximately 20 days of conventional instructional time. The mean training time required by the programed method therefore suggested a saving in time.[3]

There were no significant relationships found between spelling gain and the subject variables of sex, age, grade, or reading comprehension. However, there were negative and statistically significant correlations found between spelling gain and intelligence ($p > .01$) and between spelling gain and the vocabulary and spelling achievement variables ($p > .05$), as measured by standardized achievement test scores.[4]

Staff Attitudes

The items to which the teachers and administrators responded were grouped into two categories: (a) attitudes toward the pro-

[3] It is realized that this comparison of differences in instructional time is not valid since there were insufficient data obtained upon which to make a comparison, as well as other variables to consider. For example, a few teachers reported that they normally included more words in a given week than just the workbook words. However, the data do suggest some saving in time for the programed method when compared with the spelling instructional methods used by the majority of teachers.

[4] These negative correlations were attributed to the fact that students with high scores on these variables also tended to achieve high scores on the criterion pretest. Spelling gains by these students therefore tended to be small.

gramed method of teaching spelling and (b) attitudes and opinions concerning the potential of programed methods for general instructional use in the elementary school.[5] Because of space limitations, only the major findings in each category will be reported.

EFFECTIVENESS OF PROGRAMED INSTRUCTION IN SPELLING

In a series of questions, the teachers were asked to compare the effectiveness of the programed method with their own spelling methods and to indicate a preference.[6] Results were inconclusive in terms of criterion items involving the number of words learned per week and the amount of time required to learn a weekly spelling list. The responses were identical for each criterion measure, with teachers almost evenly divided in their opinions (five favored the programed method; four chose their own methods; three indicated little difference between methods).

In response to the question, "To what extent was the programed method effective in enabling you to work with individual students in the nonmachine group?" the majority of teachers (seven) reported having to spend "50 percent or more" of the weekly instructional time in spelling with the machine user group because of student requests for assistance in operating the machines. All the teachers expressed disappointment in interviews that mechanical difficulties prevented them from spending adequate time with students needing help in the nonmachine group.

Method preferences were similar to those described above. In responding to the question, "In light of your experience during this experiment, what is your preference for spelling instruction?" a slight majority favored the nonprogramed method. (Seven teachers and three principals chose their own methods; five teachers and three principals preferred programed spelling.)

REACTIONS TO TEACHING MACHINES

In terms of operational reliability under classroom conditions which required several hours of daily use by many students, the majority of teachers (seven) indicated that "50 percent or more" of their students experienced difficulty in operating the machines because of mechanical problems (torn or jammed programs, broken answer knobs, etc.).

[5] In this report, the terms *opinion* and *attitude* are used interchangeably to denote feelings or convictions about a specific topic as obtained from interview statements and questionnaires.

[6] Method comparisons are beyond the scope of this study since the "conventional" method was not specified. Teachers' estimates of method effectiveness were only used as a measure of the teachers' attitudes.

As might be expected, these difficulties with machine operation had a negative attitudinal effect on principals, students, and teachers. Eight teachers (all female) reported that their students lost "considerable interest in using the machine." The remaining four teachers (all male) expressed the opinion that the machine difficulties "made no difference at all" to their students. In terms of the teachers' personal feelings, the results were strikingly similar to the reports of their own students' reactions. The eight female teachers reported feelings ranging from "somewhat" to "considerably" annoyed. The four male teachers indicated that they were "not bothered at all." In interviews, the six male principals and vice principals expressed essentially the same attitudinal reactions to mechanical problems with the machines as the male teachers.

In addition to student difficulties in operation, other negative staff reactions to the teaching machines were reported. Both groups were unanimous in their opinion that the teaching machine used in the experiment, as presently designed, was "unsuitable for operational use." The reasons most frequently mentioned were (a) "unreliability," (b) "maintenance requirements," (c) "noise characteristics," and (d) "classroom storage problems caused by the size and weight of the machine."[7]

REACTIONS TO PROGRAMED SPELLING MATERIALS

Teachers and administrators were also asked to evaluate the experimental spelling programs. Both groups indicated complete agreement in listing three principal limitations of the spelling programs: (a) "lack of provision for individual differences," (b) "lack of variety," and (c) "nonresponsiveness to local curriculum objectives in spelling." The teachers and principals were unanimous in their opinion that the use of one spelling program which allows individuals to proceed at their own rate of speed does not really provide for wide ranges in student ability in a typical class. The consensus in both groups was that the programs must also contain differences in content.

A majority of teachers (eight) reported that retarded readers could not follow the simple directions used in the instructional items or understand the brief paragraphs which were used to introduce the spelling words. The consensus of staff opinion was that their own spelling methods were more individualized than

[7] The teachers and administrators suggested a number of specific design changes in the teaching machines. Because of space limitations in this paper, these suggestions will not be listed.

the experimental programs since the teachers used three ability groups, separate word lists, and different techniques for study purposes.

In terms of criticism concerning the lack of variety in the experimental programs, nine teachers reported that a large number of students complained of boredom, especially the brighter ones, after working only two weeks with the teaching machines, stating that they were "tired of using the machines" and "would be glad when the experiment was over."

The majority (seven) of the teachers and three of the six principals also expressed the opinion that their own spelling methods were more responsive to local spelling curriculum objectives. In an interview, one principal expressed the consensus of the teachers' and principals' questionnaire comments on this item when he referred to Horn's statement (2):

> The most practicable plan for meeting individual differences in spelling appears to be a combination of group teaching, supplemented by help given to individual pupils who require extra assistance. Some children require auditory cues, while others do not. Some require kinesthetic imagery as well as the visual and auditory cues. In general, poorer spellers are likely to need all the cues, and detailed study steps in learning new words, while good spellers may not need more than the visual imagery.

The principal went on to say that the experimental programs used in this study did not provide content or procedural differences along these lines. Local spelling methods, on the other hand, were believed to be similar to Horn's point of view and were therefore more effective in meeting local curriculum objectives.

One further point was made in reference to local objectives in spelling. The experimental programs were patterned after a typical commercial spelling workbook designed for national distribution. The majority of teachers (eight) and all the principals stated that the experimental programs were more related to language skills than they were to spelling and were therefore not as responsive to local needs as the teachers' own methods.

POTENTIAL OF PROGRAMED INSTRUCTION

Despite the high incidence of operational difficulties with machines and negative reactions to the spelling programs, staff attitudes toward the potential of programed instruction for general use in the elementary school were surprisingly favorable. The consensus of teacher opinion was that developments in programed instruction were taking place "less rapidly than desirable." None of the teachers agreed with questionnaire items

which suggested that teaching machines and programed instruction offer a possible "threat" to the teacher's traditional role as the primary means of instruction.

In questionnaires and interviews, enthusiasm was expressed by both teachers and administrators for "getting started with operational programs in our own schools," as several teachers stated. A number of staff members also indicated pessimism over the time it normally takes to implement new instructional techniques in schools. Almost every teacher and principal classified the potential contribution of programed instruction to the overall educational program as "strong positive" on a five-point scale.

The same favorable and enthusiastic attitudes were expressed by teachers and administrators when they were asked to state an opinion concerning the potential of programed instruction. One teacher's comments were representative of the positive statements made by almost every staff member:

> In my present class I have a wide range of student ability from 3.0 to 10.0 in grade level. With traditional instructional materials and methods, I cannot even begin to meet all of their needs. I've almost given up trying. Programed instruction offers a promise of individualizing instruction in a very effective way. These spelling programs did not meet the needs of the range of ability in my class, but I realize they were only experimental programs. I look forward to the rapid development of truly individualized instructional programs.

DISCUSSION

The results of this study suggest guidelines for educators who are interested in applications of programed instruction in school settings. The usual cautions in generalizing should be observed, however, since it is possible that the small faculty sample, the particular teaching machine, the content and style of programming, or the method in which programs and machines were employed during the experiment affected the results. However, it is believed that several inferences can be drawn from the results of the study.

First, if the decision is made to use teaching machines in order to meet specific educational objectives, educators should exercise considerable discrimination, since the selection of an unreliable machine could jeopardize the success of the instructional program, especially in terms of possible negative attitudes on the part of faculty members. Educators would be prudent in asking manufacturers for field test data concerning teaching machine

reliability, operational noise characteristics, and maintenance requirements before using machines in schools.

A second implication is that the attitudinal data reported in this study suggest the need for additional research involving faculty attitudes if programed instruction is to be successfully introduced and used in classroom settings. Based upon the history of other innovations, teachers' acceptance of a new audiovisual aid or teaching method is largely dependent upon their attitudes. Teachers who feel positive toward the value of programed instruction will probably use the method extensively. On the other hand, if teachers, especially females, feel uncomfortable with teaching machines in the room because they take up space, make too much noise, or break down, their attitudes will tend to be negative, and the machines will probably not be used. Even today, motion picture projectors, tape recorders, and other worthwhile audiovisual aids are apparently not being used in an optimal manner in many schools since many teachers seem to fear the mechanical characteristics of these devices. The implications of negative faculty attitudes seem quite clear. Unfortunate initial experiences with unreliable machines could serve to hinder seriously a school staff's attempt to introduce programed instruction into the educational program.

Finally, teacher acceptance is closely related to the degree of teacher involvement in the introduction and use of instructional innovations in the classroom. It seems reasonable that the potential of programed instruction will be most effectively realized to the extent that faculty members become actively involved in the development process. If teachers are encouraged to make contributions, perhaps in terms of determining the ways in which programed methods are used in the classroom, they will strive to accomplish worthwhile results because they have a stake in the outcome. Local school districts should consider the possibility of teacher involvement in program development. For example, in this study the teachers and principals felt that the experimental spelling programs were less responsive to local curriculum objectives in spelling than their own methods. A number of other commercially prepared programs now in use around the country have been widely criticized for the same reason, i.e., they do not fit the local situation. This raises the question of whether schools should use commercial programs which may not reflect local curriculum interests or develop their own programs.

The answer to the question of whether in the absence of adequate programs from commercial sources, schools should wait for more effective ones or begin to develop them on their own is a complex one. There appears to be considerable truth to the often-expressed statement that self-instructional programming is an art not to be undertaken by the average classroom teacher or curriculum specialist who does not have the time, talent, training, or interest in such work. However, this should not mean that talented and experienced teachers and curriculum workers with interest and enthusiasm could not be released from their regular duties and trained by professional programmers and psychologists to develop experimental programs for tryout in the local schools.

Teacher workshops, seminars, or summer institutes which are conducted by programming experts could be a way to begin. In these sessions, teachers and curriculum specialists could gain valuable experience in learning how to specify learning objectives, construct and test program items, and make revisions as needed. Regardless of whether they ever learn to develop programs or use them in local classes, the workshop experience should at least provide a better knowledge of the importance of precise instructional objectives and a deeper understanding of how children learn.

Training of local staff members in program development and possible uses of programed instruction could be one of the most important objectives of a school staff's in-service training program. This approach might also serve as an effective means of developing better teacher acceptance in the introduction of programed instruction in schools and perhaps more rapid realization of its full potential in education.

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